CHAPTER 5
PRELIMINARY PROJECT FEASIBILITY ASSESSMENT

This section presents the results of a preliminary economic evaluation for the alternative selected for analysis in this report. The results of the economic evaluation are presented in two ways, first, using a preliminary assessment of the net economic benefits, and second, as a benefit-cost measure. Each of the measures presented herein is preliminary in nature, and is not at the level of detail typically required of a feasibility-level economic analysis or for seeking Congressional authorization and appropriations.

To allow for the comparison of alternatives with different time frames and varying costs or benefits over time, benefits and costs are typically amortized over the project life to yield annualized benefits and costs. The two comparisons made in this preliminary assessment are summarized below:

$$\textit{Net Benefits} = \textit{Average Annual Benefits} - \textit{Average Annual Costs}$$

$$\textit{Benefit-Cost Ratio} = \frac{\textit{Average Annual Benefits}}{\textit{Average Annual Costs}}$$

Estimates are based on a 100-year project life cycle and concept-level engineering designs, costs, and benefit estimations, and are presented at 2006 price levels. The stream of annual benefits and costs has been adjusted (discounted) to the base year of 2016.

As described in **Chapter 2**, the alternative selected for analysis in this report includes the following major elements:

- Raise the existing Los Vaqueros Dam in-place to create a reservoir with a total capacity of 275 TAF
- Expand the existing Old River intake and pumping plant by 170 cfs to a total capacity of 420 cfs
- Construct a new 350 cfs pipeline from the expanded Old River intake to the existing Transfer Facility (paralleling the existing 320 cfs pipeline to provide total conveyance of 670 cfs from the Delta to the Transfer Facility)
- Replace the existing Transfer Facility balancing reservoir with a larger, 8 MG reservoir
- Construct a new 470 cfs pump station at the Transfer Facility and replace pumps in the existing 200 cfs transfer pump station, for a total transfer capacity of 670 cfs to the expanded reservoir
- Construct a new 670 cfs pipeline from the Transfer Facility to Los Vaqueros Reservoir

- Construct a new 175 cfs pump station and new pipeline to convey water from Los Vaqueros Reservoir to the SBA at the Dyer Canal

The average annual yield in terms of EWA replacement supplies is estimated as 104,200 acre-feet per year for this alternative, based on preliminary model simulations (see **Chapter 2** for modeling conditions). This alternative is used only for the purpose of preliminary economic analysis in this report to determine if a potentially feasible alternative exists under current plan formulation parameters. The following sections summarize and provide a comparison of net costs and benefits for this alternative.

ESTIMATED PROJECT BENEFITS

The following potential project benefits were included in this initial analysis: EWA replacement supplies, Bay Area emergency water supply, Bay Area water quality, and fishery protection benefits. Average annual benefits for the alternative selected in this report are summarized in **Table 5.1**.

TABLE 5.1
SUMMARY OF AVERAGE ANNUAL PROJECT BENEFITS

Project Purpose	Annual Value of Benefits 2006 Prices ($ millions)
EWA Replacement Supply	22.6 to 44.5
Water Supply Reliability	0.0
Emergency Water Supply	5.0
Water Quality	5.5
Fishery Protection	1.7
Total Annual Benefits	**34.8 to 56.7**

KEY: EWA = Environmental Water Account

The range in EWA benefits displayed in **Table 5.1** reflects a range of potential spot market price growth paths from 0 percent to 2 percent (above inflation), assuming a $1,200 price cap (representing the cost of desalinating brackish supplies). The fact that small differences in price growth patterns or price caps can result in large benefit differences underscores the potential risk of relying on spot markets to provide reliable water supplies over the longterm. Details regarding these calculations can be found in **Chapter 4.**

Although EWA benefit valuation was a primary focus of this report, a preliminary estimate of other potential project benefits was also made. Water supply reliability, water quality, and fishery benefit methods are described in **Chapter 4,** and preliminary estimates for these potential benefits are summarized briefly below.

Emergency Water Supply Benefits

The reservoir expansion alternative selected for analysis in this report was operated primarily to provide EWA replacement supplies. Although no yield was dedicated to improving Bay Area water supply reliability, the project would provide emergency supplies in the event of an earthquake or levee failure in the Delta. Consequently, the water supply reliability benefits calculated for the alternative are based solely on preliminary estimates of the value of these emergency supplies. Future analyses will evaluate the economic tradeoffs associated with supplying water for the EWA versus urban supply reliability purposes.

Emergency storage benefits are the value of supplies stored in Los Vaqueros Reservoir in the event of a major levee failure in the Delta that would significantly degrade water quality, or a major earthquake in the Bay Area that would disrupt the ability of Bay Area water agencies to import water into their service areas. With a connection from Los Vaqueros to the SBA, the expanded reservoir could deliver (either directly or by exchange) to nearly any Bay Area water agency. The amount of water available for emergency purposes is estimated as the average reservoir storage with the expanded reservoir, less the average storage without the expansion. On average, the expected available emergency storage supply is 143,400 acre-feet. For the purpose of this initial economic analysis, the value of this water during an emergency was conservatively estimated to be $1,700 per acre-foot (2006 price levels). Various estimates exist of the probability of levee failures and large earthquakes on the three major faults that cross the study area. Based on work by others, the combined probability of an earthquake or levee emergency occurring is estimated as once in every 50 years, or a 2 percent chance in any year. Using these values, the economic benefit of additional water stored in an expanded Los Vaqueros Reservoir is estimated to be about $5.0 million per year (2006 price levels). These estimates are preliminary and future analysis would be needed to refine the methodology and estimates for inclusion in a feasibility report.

Water Quality Benefits

Water quality benefits result from improvements to the water quality of municipal supplies. These improvements fall into three categories:

1. Lower consumer costs associated with changes in TDS and TH
2. Lower groundwater management costs through recharging the local groundwater basins with lower TDS water
3. Lower water treatment costs through delivering water with lower turbidity, TOC, and bromides

The alternative evaluated in this report would result in water quality improvement to SBA users; CCWD would not experience any improvements over future without-project conditions. Consumer-related water quality cost savings were estimated using methodologies developed by Sonnen (2002) for initial studies of the Los Vaqueros expansion. The economic benefit was estimated by subtracting the consumer costs for the without-project condition from the costs of the with-project condition. These cost savings were estimated for agencies receiving water from the SBA. The analysis estimated that 248,000 households receive treated water from the SBA. The analysis also assumed that CCWD would receive no water quality improvements from the

expansion project. The estimated water quality benefits of the alternative evaluated in this report are summarized in **Table 5.2**.

TABLE 5.2
SUMMARY OF ESTIMATED WATER QUALITY BENEFITS

Benefit Type	Annual Benefits (2006 Prices)
Consumer Savings	$3.2 million
Groundwater Management	$2.3 million
Water Treatment Plant Savings[1]	Not estimated
Total Water Quality Benefits	**$5.5 million**

Notes:
1. The value of reduced costs at water treatment plants was not estimated in this initial economic evaluation.

Several categories of consumer costs savings were used to estimate the economic benefits:

- Reduced bottled water purchases (accounting for about $0.61 million per year in avoided costs)
- Longer life of household appliances, plumbing, and fixtures (accounting for about $2.05 million per year in avoided costs)
- Lower use of home water softeners (accounting for about $0.43 million per year in avoided costs)
- Reduced purchases of soaps and detergents (accounting for about $0.02 million per year in avoided costs)

These benefits accrue when water supplies with lower TDS and TH are delivered to households served by water treatment plants that receive water from the SBA. The benefits are equivalent to a savings of about $12.50 per household per year.

Economic benefits from lower groundwater basin management costs were estimated using the avoided cost approach. The with-project condition delivers lower TDS water for groundwater recharge in the SBA service area. Groundwater recharge occurs from two primary sources: active recharge via spreading basins, and passive recharge from outdoor irrigation of urban landscapes. The with-project condition reduced the average annual salt loading to the groundwater basins by 2,300 tons (TDS). To achieve the same reduction in salinity would require desalination of these supplies prior to recharge. The avoided cost of desalination is estimated to be $1,000 per ton TDS, resulting in an avoided treatment cost of $2.3 million annually. This value is equivalent to about $22 per acre-foot recharged.

Savings in water treatment plant operating costs were not estimated as part of this evaluation. CCWD is currently developing a detailed water quality model that will estimate the water quality parameters of interest in this benefit category. This model is expected to be available by the end of 2006, and available for use in subsequent feasibility analyses.

Fishery Benefits

Fishery benefits could potentially fall into the category of other direct benefits for the NED analysis. Water delivered to the SBA from Los Vaqueros Reservoir would be diverted from the Delta through modern, positive-barrier fish screens similar to the existing fish screens at CCWD's Old River intake and pumping station. Currently, water delivered to the SBA passes through Clifton Court Forebay, which does not have fish screens. The economic benefit of diverting water through a screened intake versus an unscreened intake could be valued in several ways. For the purpose of this initial economic analysis, two potential methods were considered:

- **Avoided cost of fish screens at Clifton Court –** The first method estimates the fishery benefit as the cost of providing a fish screen of equivalent size (170 cfs) and type at Clifton Court Forebay. The cost of installing new screens at Clifton Court Forebay has been estimated by others to range between $1.0 and $1.5 billion for an ultimate capacity of 10,500 cfs. This cost is roughly equivalent to between $95,000 and $143,000 per cfs screened. Over a 100-year project life, and using the same assumptions concerning replacement costs and O&M used in the construction cost estimate for the expansion alternative, this results in an annual avoided cost of between $1.3 and $1.9 million.
- **Valuation using CVPIA fishery mitigation charge** – This valuation approach is based on the fish and wildlife mitigation charge for CVP contractors, established by Congress through the CVPIA, to pay for fishery protection and other environmental projects. This charge is currently $16 per acre-foot for CVP M&I contractors. Applying this valuation to the average annual EWA supply of 104,200 acre-feet developed by the alternative under evaluation would result in an annual economic benefit of about $1.71 million.

For the purpose of this initial economic evaluation, the CVPIA mitigation charge valuation method resulting in an economic benefit of $1.67 million was used. Further analysis is needed to better define the nature of potential fishery benefits and the methods to value the benefits, if appropriate.

Lower Cost EWA Water Supply

The lower cost EWA water supply developed through this project will be a key part of the NED analysis. The P&G note that cost reduction benefits apply when the same level of output is attained at lower cost. This is the assumption of identifying whether LVE can provide a lower cost alternative to meeting current EWA objectives and accomplishments.

The benefit of the LVE project will be the avoided spot market water purchases, given that the net present value of the average annual costs of the project is less than the market. The annual spot market value used will depend on the year, ultimate price path projection, and appropriate market cap applied.

IMPLEMENTATION COSTS

Total implementation costs include construction cost, IDC, and annual O&M and replacement costs.

Construction Cost

Designs and costs are based primarily on the cost to construct the existing Los Vaqueros Project facilities, which were completed in 1997. The facility cost estimates use existing appraisal-level engineering and designs and unit cost data presented in the *Project Cost Estimate Methodology Technical Memorandum* (CALFED, 2004a). Unit costs were updated from 2002 to 2006 prices using the Engineering News Report Construction Cost Index (CCI) for the San Francisco Region. The total first cost includes 15 percent for unlisted items and an additional 25 percent contingency, per Reclamation guidance for appraisal-level cost estimates. To obtain an estimate of total implementation cost, 25 percent was added to the total field cost to account for engineering design, construction inspection, administrative, and legal costs. Lands and easements required for implementation and mitigation costs were not specifically calculated, but are believed to be represented within the unlisted items and contingencies. The cost estimates in this report are not intended to be at the feasibility-level required to request project authorization or appropriations for construction.

A construction period of 3 years is assumed for the 275 TAF reservoir and related facilities, based on preliminary engineering and construction scheduling. Construction would be completed by the end of 2015, and the project would be operational starting in 2016. This schedule is based on the following assumptions: (1) a ROD will be made in early 2009, with Congressional authorization and appropriations available to commence design work in 2010, and (2) funding and other limitations will not impact the implementation schedule. It is also assumed that all future without-project conditions are fully realized when the expanded reservoir becomes functional (i.e., the AIP would be in place).

Interest During Construction

IDC accounts for costs incurred during the construction period. Interest is computed using the project discount rate of 5-1/8 percent from the construction start date to the beginning of the period of analysis. IDC is applied to total field cost (including unlisted items and contingencies, but excluding engineering design, inspection, administrative, and legal costs). IDC was calculated based on 2006 construction dollars.

Annual Operation, Maintenance, and Replacement Costs

Annual O&M and replacement values were developed as percentages of facility field costs (including unlisted items and contingencies). The O&M percentages are based partially on industry averages but primarily on actual O&M costs incurred by CCWD for the existing Los Vaqueros Project. Replacements are assumed to occur every 40 years and are expressed as a percentage of total pump station and substation/transmission facility costs. Percentage of facility costs for annual operation (excluding power), maintenance, and replacement are summarized in **Table 5.3**.

TABLE 5.3
ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT

	Facility	% of Facility Cost
O&M (excluding power)	Dam	0.1%
	Intakes	1.0%
	Pipelines	0.5%
	Pump Stations	1.0%
	Power Supply Facilities	0.8%
Replacements (every 40 years)	Pump Stations and Substations	35%

KEY: O&M = operation and maintenance

A large portion of the annual operating costs of an expansion project would arise from the cost to pump water into the reservoir and deliver supplies to the SBA. The expansion project also has the potential to affect pumping at other Delta pumping facilities because of its interaction with the EWA and with CCWD water supply and quality operations. These effects may result in increased or decreased pumping at different times of the year at CCWD's Rock Slough, Old River, and AIP pump stations, as well as the SWP's Banks and South Bay pumping plants. Consequently, net energy costs were estimated as the difference in pumping costs between the with-project and without-project conditions at these facilities. An average rate of $0.10 per kilowatt-hour was used to estimate the cost of pumping.

Costs Not Included

Costs not included in this initial economic analysis include the following:

- Betterments that may be desired as part of a locally preferred plan are not included in the calculation of costs. This may include betterments associated with relocations or replacements (improvements beyond replacement-in-kind of facilities impacted by a project). Betterments or add-ons requested by a local sponsor may be included in a locally preferred plan.
- Costs related to lands and easements and mitigation were not directly calculated, but are believed to be represented within the appraisal-level provisions for unlisted items and contingencies.
- The opportunity cost of lands inundated by an expanded reservoir are not included. Watershed lands surrounding the existing reservoir are currently owned by CCWD, and future development of these lands is restricted to preserve reservoir water quality.
- Avoided costs related to O&M or replacement of existing facilities that would be replaced or abandoned as part of an expansion project are not considered in this analysis.
- O&M costs related to the AIP and Old River Pumping Plant (facilities that would exist at the time of project implementation/construction and operate in the future without-project condition) are not included as part of project costs.

- Costs related to potential degradation in CCWD's Delta water supplies during the 3-year construction period (while the reservoir would be drawn down) are not included. The combination of CCWD's existing Delta intakes with the proposed AIP would provide some flexibility in meeting CCWD's water quality goals during construction.

Summary of Implementation Costs

Project costs for the 275 TAF reservoir alternative evaluated in this report are summarized in **Table 5.4**.

TABLE 5.4
SUMMARY OF ESTIMATED PROJECT COSTS FOR SELECTED ALTERNATIVE

Type	Item	Cost[4]
Implementation Costs	Los Vaqueros Dam and Appurtenances	$139,426,000
	Delta Intake, Pumping, and Conveyance to Transfer Facility	$42,669,000
	Transfer Facility Pumping and Conveyance to Reservoir	$76,957,000
	Pumping and Conveyance from Reservoir to SBA	$48,783,000
	Total Field Cost	**$307,835,000**
	Unlisted Items (15%)	$46,176,000
	Subtotal	**$354,011,000**
	Contingency (25%)	$88,503,000
	Total First Cost	**$442,514,000**
	Indirect Costs[1] (25%)	$110,629,000
	Subtotal	**$553,143,000**
	Interest During Construction[2]	$43,746,000
	Total Implementation Cost	**$596,889,000**
Annual Operation, Maintenance, Repair, And Replacements	**Operation and Maintenance**	
	- Dam and Appurtenances	$211,200
	- Delta Intake	$82,500
	- Pipelines	$645,500
	- Pump Stations	$792,000
	- Substations and Transmission Lines	$61,500
	Subtotal	**$1,792,700**
	Net Power[3]	$1,518,000
	Replacements (annualized)	$235,400
	Total Annual OMR&R	**$3,546,100**
	Capital Value of OMR&R	**$70,353,000**
TOTAL COSTS	**Capital Value of All Costs**	**$667,242,000**
	Average Annual Cost over 100 Years	**$34,429,000**

KEY: SBA = South Bay Aqueduct OMR&R = operation, maintenance, repair and replacement

Notes:

1. *Indirect costs include engineering, design, inspection, administration, and legal costs.*
2. *Interest during construction calculated for a 3-year construction period.*
3. *Net power cost represents the difference between pumping costs in the with-project and without-project conditions.*
4. *All costs are presented at 2006 price levels.*

The unit cost of EWA replacement yield is the estimated average annual cost to develop the project divided by the estimated yield of the project. Estimated average annual EWA replacement yield for the alternative selected in this analysis is about 104,200 acre-feet per year, resulting in a unit cost of about $330 per acre-foot for this alternative.

COMPARISON OF BENEFITS AND COSTS

The total annual costs and benefits identified in this analysis are summarized in **Table 5.5**. Benefit estimation methods are described in greater detail in **Chapter 4**. EWA benefits are presented for three potential future spot market water price escalation trends: 0 percent, 1.1 percent, and 2 percent annually. As shown, the alternative evaluated in this initial economic analysis provides positive average annual net economic benefits between $0.37 million and $22.30 million and a ratio of average annual benefits to costs between 1.01 and 1.65, depending on the price escalation underlying the EWA benefits calculations.

The 0 percent growth rate is presented in **Table 5.5** as a low book end for the purpose of this initial economic evaluation, but this trend is unlikely to occur. A 4 percent growth rate was also examined as a high book end, but is not presented in the table because the lower growth rates resulted in positive net benefits.

TABLE 5.5
SUMMARY OF AVERAGE ANNUAL ECONOMIC EFFECTS

		2006 Price Levels ($ millions)[1]		
		0% Real Price Escalation	1.1% Real Price Escalation	2% Real Price Escalation
Costs	**Total Annual Costs[2]**	**(34.43)**	**(34.43)**	**(34.43)**
Benefits	EWA Replacement Supplies	22.56	32.31	44.49
	Water Supply Reliability	0.00	0.00	0.00
	Emergency Water Supply	5.00	5.00	5.00
	Bay Area Water Quality	5.53	5.53	5.53
	Fishery Benefits[3]	1.71	1.71	1.71
	Total Annual Benefits	**34.80**	**44.55**	**56.73**
Net Benefits	**Net of Annual Costs & Benefits**	**0.37**	**10.12**	**22.30**
	Ratio of Annual Benefits to Costs (B:C)	**1.01**	**1.29**	**1.65**

KEY: EWA = Environmental Water Account

Notes:

1. *Values reflect 2006 price levels with the exception of EWA benefits (which have been escalated based on a range of potential growth rates above inflation, then discounted back using the Federal discount rate of 5-1/8 percent). A $1,200 per acre-foot price cap was applied to EWA benefits (corresponding to the cost to desalinate brackish water).*
2. *Total annual costs include implementation (construction cost with unlisted items and contingencies, interest during construction, and engineering, administration, and legal costs), operation and maintenance, power, and major replacements.*
3. *Further analysis is needed to better define the nature of potential fishery benefits and the methods to value the benefits, if appropriate.*

Because net benefits are greater than zero and the benefit-cost ratio is greater than 1, this alternative would be considered economically feasible. This conclusion is preliminary, and may be revised after a more thorough evaluation of project benefits and costs for the feasibility study.

Sensitivity and Uncertainty

Uncertainty and variability are inherent in water resources planning, and the P&G provide guidance for evaluating risk and uncertainty in the formulation of alternative plans. Ideally, risk and uncertainty should be characterized by probability distributions based on well-established empirical data (such as hydrologic uncertainty). But the P&G recognize that many aspects of today's projects cannot be characterized in this manner. In this case, a range of likely outcomes may be described by using sensitivity analysis, the process of testing the sensitivity of an outcome to variation in key parameters. Analyses should attempt to characterize the sources and nature of uncertainty to determine how sensitive outcomes are to changes in assumptions.

For this initial economic analysis, key areas of uncertainty relate to the following:

- The rate of growth in water transfer prices, and the extent to which these prices may or may not reflect the opportunity cost of the water supply in other uses, is uncertain and requires further analysis.
- The continued presence of the EWA or similar program in the future is uncertain, including the level of Federal participation in such a program. To date, the EWA has predominantly benefited the SWP by maintaining reliable supplies to SWP contractors.
- Operations modeling results used in this initial economic analysis used the stand-alone CALSIM-II operations model. Future analyses using the integrated CALSIM-II model, under development by the CALFED Common Assumptions group, will allow assessment of how an expansion of Los Vaqueros might affect other Central Valley water management operations. This may lead to refinements in reservoir operations and adjustments in yield.
- Existing and potential future Delta pumping and export constraints (biological opinions, E/I ratio restrictions, future restoration actions, etc.) could affect ability to fill the expanded reservoir or increase the cost to achieve the same benefits. Adaptive management and operational flexibility should be assessed in future analyses.
- Water quality delivered to the SBA generally increases for the alternative selected for evaluation in this report. Future model runs will investigate operation methods to mitigate potential seasonal fluctuations in delivered water quality.
- The cost estimates used in the initial economic analysis are based on appraisal-level engineering and designs. Consequently, conservative factors were applied to account for unlisted items and contingencies. Detailed engineering and design work is needed to refine the cost estimates.
- Numerous factors exist that could potentially impact future water demands, supplies, and scarcity, and could affect operation of the State's water management system. All of these factors have the potential to influence prices on the water transfer spot market.